

This listing of claims will replace all prior versions, and listings, of claims in the application:

1 Claim 1 (currently amended): A computer-implemented method  
2 comprising:  
3 a) accepting forwarding liveness status information  
4 of at least two different interfaces;  
5 b) composing ~~[[a]]~~ an aggregated message including  
6 the forwarding liveness status information of the at  
7 least two different interfaces as data within the  
8 aggregated message; and  
9 c) sending the aggregated message towards a neighbor  
10 node.

1 Claim 2 (currently amended): The computer-implemented  
2 method of claim 1 further comprising:  
3 d) maintaining a first timer for tracking a send time  
4 interval, wherein the acts of composing ~~[[a]]~~ the  
5 aggregated message and sending the aggregated message  
6 are performed after expiration of the first timer; and  
7 e) restarting the first timer after the aggregated  
8 message is sent.

1 Claim 3 (currently amended): The computer-implemented  
2 method of claim 2 wherein the aggregated message further  
3 includes a dead time interval, and wherein the send time  
4 interval is less than the dead time interval.

1 Claim 4 (currently amended): The computer-implemented  
2 method of claim 2 wherein the aggregated message further  
3 includes a dead time interval, and wherein the send time

4 interval is no more than one third of the dead time  
5 interval.

1 Claim 5 (previously presented): The computer-implemented  
2 method of claim 2 wherein the send time interval is less  
3 than one second.

1 Claim 6 (previously presented): The computer-implemented  
2 method of claim 2 wherein the send time interval is less  
3 than 100 msec.

1 Claim 7 (currently amended): The computer-implemented  
2 method of claim 1 wherein the aggregated message further  
3 includes a dead time interval.

1 Claim 8 (currently amended): The computer-implemented  
2 method of claim 1 wherein the act of sending the aggregated  
3 message includes providing the aggregated message in an  
4 Internet protocol packet.

1 Claim 9 (currently amended): The computer-implemented  
2 method of claim 8 wherein the aggregated message is sent  
3 towards the neighbor node by setting a destination address  
4 in the Internet protocol packet to a multicast address  
5 associated with routers that support aggregated interface  
6 forwarding liveness.

1 Claim 10 (previously presented): The computer-implemented  
2 method of claim 1 wherein the status information includes a  
3 forwarding liveness state selected from a group of  
4 forwarding liveness states consisting of (A) interface up,

5 (B) interface down, (C) interface monitor not reporting,  
6 and (D) forwarding engine restarting.

1 Claim 11 (currently amended): For use with a node, a  
2 computer-implemented method comprising:

- 3 a) receiving [[a]] an aggregated message including  
4 i) forwarding liveness status information for a  
5 first set of at least two different interfaces as  
6 data within the aggregated message, and  
7 ii) a time interval; and  
8 b) updating neighbor node forwarding liveness status  
9 information using the aggregated message.

1 Claim 12 (previously presented): The computer-implemented  
2 method of claim 11 wherein the act of updating neighbor  
3 node liveness status information includes

- 4 i) setting a first timer to the time interval  
5 and starting the first timer,  
6 ii) if the first timer expires, setting a status  
7 of each of the at least two different interfaces  
8 of the neighbor node to down; and  
9 iii) if a further message, sourced from the  
10 neighbor node, and including  
11 A) forwarding liveness status information,  
12 and  
13 B) a new time interval,  
14 is received then, resetting the first timer to  
15 the new time interval and restarting the first  
16 timer.

1 Claim 13 (previously presented): The computer-implemented  
2 method of claim 12 wherein each of the time interval and  
3 the new time interval is less than one second.

1 Claim 14 (previously presented): The computer-implemented  
2 method of claim 11 wherein the forwarding liveness status  
3 information is interface forwarding liveness status  
4 information.

1 Claim 15 (previously presented): The computer-implemented  
2 method of claim 11 wherein the status information includes  
3 a forwarding liveness state selected from a group of  
4 forwarding liveness states consisting of (A) interface up,  
5 (B) interface down, (C) interface monitor not reporting,  
6 and (D) forwarding engine restarting.

1 Claim 16 (previously presented): The computer-implemented  
2 method of claim 11 wherein the forwarding liveness status  
3 information includes at least one of (i) the integrity and  
4 correct operation of forwarding tables, (ii) the integrity  
5 and correct operation of switch fabric, (iii) the integrity  
6 and correct operation of a forwarding lookup engine, (iv)  
7 the integrity and correct operation of a traffic scheduler,  
8 (v) the integrity and correct operation of a traffic  
9 classifier, (vi) the integrity and correct operation of  
10 buffers in the data plane, (vii) the integrity and correct  
11 operation of packet segmentation modules, (viii) the  
12 integrity and correct operation of packet reassembly  
13 modules, (ix) the integrity and correct operation of packet  
14 re-sequencing modules, (x) whether or not a node is  
15 restarting, (xi) whether or not the forwarding plane is

16 congested, or (xii) the integrity and correct operation of  
17 fragmentation modules.

1 Claim 17 (previously presented): The computer-implemented  
2 method of claim 11 wherein the forwarding liveness status  
3 information includes at least one of (i) bit error rate at  
4 a link interface, and (ii) clock synchronization at a link  
5 interface.

1 Claim 18 (currently amended): A computer-implemented  
2 method for monitoring interface forwarding liveness, the  
3 method comprising:  
4 a) determining, at a first node, forwarding liveness  
5 status information for at least two different  
6 interfaces;  
7 b) sending, from the first node, [[a]] an aggregated  
8 message including the determined status information  
9 for the at least two different interfaces as data  
10 within the aggregated message;  
11 c) receiving, at the second node, the aggregated  
12 message; and  
13 d) updating, by the second node, first node  
14 forwarding liveness status information using the  
15 aggregated message.

1 Claim 19 (currently amended): The computer-implemented  
2 method of claim 18 wherein the aggregated message further  
3 includes a dead interval, and wherein the act of updating  
4 first node forwarding liveness status information includes  
5 i) setting a timer to the dead interval;  
6 ii) starting the timer;

7           iii) determining whether or not a further  
8           message including forwarding liveness status  
9           information is received from the first node  
10          before the expiration of the timer; and  
11          iv) if it is determined that a further message  
12          including forwarding liveness status information  
13          is not received from the first node by the second  
14          node before the expiration of the timer, then  
15          informing the second node that the at least two  
16          different interfaces of the first node are down.

1   Claim 20 (previously presented): The computer-implemented  
2   method of claim 18 wherein the status information includes  
3   a forwarding liveness state selected from a group of  
4   forwarding liveness states consisting of (A) interface up,  
5   (B) interface down, (C) interface monitor not reporting,  
6   and (D) forwarding engine restarting.

1   Claim 21 (previously presented): The computer-implemented  
2   method of claim 18 wherein the forwarding liveness status  
3   information includes at least one of (i) the integrity and  
4   correct operation of forwarding tables, (ii) the integrity  
5   and correct operation of switch fabric, (iii) the integrity  
6   and correct operation of a forwarding lookup engine, (iv)  
7   the integrity and correct operation of a traffic scheduler,  
8   (v) the integrity and correct operation of a traffic  
9   classifier, (vi) the integrity and correct operation of  
10   buffers in the data plane, (vii) the integrity and correct  
11   operation of packet segmentation modules, (viii) the  
12   integrity and correct operation of packet reassembly  
13   modules, (ix) the integrity and correct operation of packet  
14   re-sequencing modules, (x) whether or not a node is

15 restarting, (xi) whether or not the forwarding plane is  
16 congested, or (xii) the integrity and correct operation of  
17 fragmentation modules.

1 Claim 22 (previously presented): The computer-implemented  
2 method of claim 18 wherein the forwarding liveness status  
3 information includes at least one of (i) bit error rate at  
4 a link interface, and (ii) clock synchronization at a link  
5 interface.

Claims 23-28 (canceled)

1 Claim 29 (currently amended): For use with a node,  
2 ~~[[elements]]~~ apparatus comprising:  
3     a) one or more processors;  
4     b) at least one input device; and  
5     c) one or more storage devices storing  
6     processor-executable instructions which, when executed  
7     by one or more processors, perform a method of:  
8         [[a]] i) ~~[[means-for]]~~ accepting forwarding  
9         liveness status information of at least two  
10        different interfaces;  
11        [[b]] ii) ~~[[means-for]]~~ composing [[a]] an  
12        aggregated message including the forwarding  
13        liveness status information of the at least two  
14        different interfaces as data within the  
15        aggregated message; and  
16        [[c]] iii) ~~[[means-for]]~~ sending the aggregated  
17        message towards a neighbor node.

1 Claim 30 (currently amended): The ~~[[elements]]~~ apparatus  
2 of claim 29 further comprising:

3           [[e]] iv) ~~[[means-for]]~~ maintaining a first  
4           timer for tracking a send time interval, wherein  
5           the ~~[[means-for]]~~ act of composing [[a]] the  
6           aggregated message and sending the aggregated  
7           message compose and send the aggregated message  
8           after expiration of the first timer; and  
9           [[e]] v) ~~[[means-for]]~~ restarting the first  
10          timer after the aggregated message is sent.

1   Claim 31 (currently amended): The ~~[[elements]]~~ apparatus  
2   of claim 30 wherein the aggregated message further includes  
3   a dead time interval, and wherein the send time interval is  
4   less than the dead time interval.

1   Claim 32 (currently amended): The ~~[[elements]]~~ apparatus  
2   of claim 30 wherein the aggregated message further includes  
3   a dead time interval, and wherein the send time interval is  
4   no more than one third of the dead time interval.

1   Claim 33 (currently amended): The ~~[[elements]]~~ apparatus  
2   of claim 30 wherein the send time interval is less than one  
3   second.

1   Claim 34 (currently amended): The ~~[[elements]]~~ apparatus  
2   of claim 30 wherein the send time interval is less than 100  
3   msec.

1   Claim 35 (currently amended): The ~~[[elements]]~~ apparatus  
2   of claim 29 wherein the aggregated message further includes  
3   a dead time interval.



1 Claim 36 (currently amended): The ~~[[elements]]~~ apparatus  
2 of claim 29 wherein the ~~[[means-for]]~~ act of sending the  
3 aggregated message includes ~~[[include-means-for]]~~ providing  
4 the aggregated message in an Internet protocol packet.

1 Claim 37 (currently amended): The ~~[[elements]]~~ apparatus  
2 of claim 36 wherein the ~~[[means-for]]~~ act of sending the  
3 aggregated message includes ~~[[include-means-for]]~~ setting a  
4 destination address in the Internet protocol packet to a  
5 multicast address associated with routers that support  
6 interface forwarding liveness.

1 Claim 38 (currently amended): The ~~[[elements]]~~ apparatus  
2 of claim 29 wherein the status information includes a  
3 forwarding liveness state selected from a group of  
4 forwarding liveness states consisting of (A) interface up,  
5 (B) interface down, (C) interface monitor not reporting,  
6 and (D) forwarding engine restarting.

1 Claim 39 (currently amended): For use with a node,  
2 ~~[[elements]]~~ apparatus comprising:  
3     a) one or more processors;  
4     b) at least one input device; and  
5     c) one or more storage devices storing  
6     processor-executable instructions which, when executed  
7     by one or more processors, perform a method of:  
8         ~~[[a]]~~ i) ~~[[means-for]]~~ receiving ~~[[a]]~~ an  
9         aggregated message including  
10         ~~[[+]]~~ A) forwarding liveness status  
11         information for a first set of at least two  
12         different interfaces as data within the  
13         aggregated message, and

14           ~~[[i]]~~ B) a time interval; and  
15           ~~[[i]]~~ ii) ~~[[means-for]]~~ updating neighbor node  
16 forwarding liveness status information using the  
17 aggregated message.

1 Claim 40 (currently amended): The ~~[[elements]]~~ apparatus  
2 of claim 39 wherein the ~~[[means-for]]~~ act of updating  
3 neighbor node liveness status information ~~[[include]]~~  
4 includes  
5           ~~[[i]]~~ A) ~~[[means-for]]~~ setting a first  
6 timer to the time interval and starting the  
7 first timer,  
8           ~~[[i]]~~ B) ~~[[means-for]]~~ setting a status  
9 of each of the at least two different  
10 interfaces of the neighbor node to down if  
11 the first timer expires; and  
12           ~~[[i]]~~ C) ~~[[means-for]]~~ if a further message,  
13 sourced from the neighbor node, and  
14 including  
15           ~~[[A]]~~ 1) forwarding liveness status  
16 information, and  
17           ~~[[B]]~~ 2) a new time interval,  
18 is received, ~~[[for]]~~ resetting the first  
19 timer to the new time interval and  
20 restarting the first timer.

1 Claim 41 (currently amended): The ~~[[elements]]~~ apparatus  
2 of claim 39 wherein each of the time interval and the new  
3 time interval is less than one second.

1 Claim 42 (currently amended): The ~~[[elements]]~~ apparatus  
2 of claim 39 wherein the forwarding liveness status

3 information is interface forwarding liveness status  
4 information.

1 Claim 43 (currently amended): The ~~[[elements]]~~ apparatus  
2 of claim 39 wherein the status information includes a  
3 forwarding liveness state selected from a group of  
4 forwarding liveness states consisting of (A) interface up,  
5 (B) interface down, (C) interface monitor not reporting,  
6 and (D) forwarding engine restarting.

1 Claim 44 (currently amended): The ~~[[elements]]~~ apparatus  
2 of claim 39 wherein the forwarding liveness status  
3 information includes at least one of (i) the integrity and  
4 correct operation of forwarding tables, (ii) the integrity  
5 and correct operation of switch fabric, (iii) the integrity  
6 and correct operation of a forwarding lookup engine, (iv)  
7 the integrity and correct operation of a traffic scheduler,  
8 (v) the integrity and correct operation of a traffic  
9 classifier, (vi) the integrity and correct operation of  
10 buffers in the data plane, (vii) the integrity and correct  
11 operation of packet segmentation modules, (viii) the  
12 integrity and correct operation of packet reassembly  
13 modules, (ix) the integrity and correct operation of packet  
14 re-sequencing modules, (x) whether or not a node is  
15 restarting, (xi) whether or not the forwarding plane is  
16 congested, or (xii) the integrity and correct operation of  
17 fragmentation modules.

1 Claim 45 (currently amended): The ~~[[elements]]~~ apparatus  
2 of claim 39 wherein the forwarding liveness status  
3 information includes at least one of (i) bit error rate at

4 a link interface, and (ii) clock synchronization at a link  
5 interface.

1 Claim 46 (currently amended): A system comprising:

2 a) a first node including

3 i) one or more processors;  
4 ii) at least one input device; and  
5 iii) one or more storage devices storing  
6 processor-executable instructions which, when  
7 executed by one or more processors, perform a  
8 method of:

9 [[~~±~~]] A) [[~~means for~~]] determining, at a  
10 first node, forwarding liveness status  
11 information for at least two different  
12 interfaces, and  
13 [[~~±~~]] B) [[~~means for~~]] sending [[~~a~~]] an  
14 aggregated message including the determined  
15 status information for the at least two  
16 different interfaces as data within the  
17 aggregated message; and

18 b) a second node including

19 i) one or more processors;  
20 ii) at least one input device; and  
21 iii) one or more storage devices storing  
22 processor-executable instructions which, when  
23 executed by one or more processors, perform a  
24 method of:

25 [[~~±~~]] A) [[~~means for~~]] receiving the aggregated  
26 message, and  
27 [[~~±~~]] B) [[~~means for~~]] updating first node  
28 forwarding liveness status information using the  
29 aggregated message.

1 Claim 47 (currently amended): The system of claim 46  
2 wherein the aggregated message further includes a dead  
3 interval, and wherein the ~~[[means for]]~~ act of updating  
4 first node forwarding liveness status information  
5 ~~[[include]]~~ includes  
6 i) ~~[[means for]]~~ setting a timer to the dead  
7 interval;  
8 ii) ~~[[means for]]~~ starting the timer;  
9 iii) ~~[[means for]]~~ determining whether or not a  
10 further message including forwarding liveness  
11 status information is received from the first  
12 node before the expiration of the timer; and  
13 iv) ~~[[means for]]~~ informing the second node that  
14 the at least two different interfaces of the  
15 first node are down if it is determined that a  
16 further message including forwarding liveness  
17 status information is not received from the first  
18 node by the second node before the expiration of  
19 the timer.

1 Claim 48 (currently amended): The ~~[[network]]~~ system of  
2 claim 46 wherein the status information includes a  
3 forwarding liveness state selected from a group of  
4 forwarding liveness states consisting of (A) interface up,  
5 (B) interface down, (C) interface monitor not reporting,  
6 and (D) forwarding engine restarting.

1 Claim 49 (previously presented): The system of claim 46  
2 wherein the forwarding liveness status information includes  
3 at least one of (i) the integrity and correct operation of  
4 forwarding tables, (ii) the integrity and correct operation  
5 of switch fabric, (iii) the integrity and correct operation

6 of a forwarding lookup engine, (iv) the integrity and  
7 correct operation of a traffic scheduler, (v) the integrity  
8 and correct operation of a traffic classifier, (vi) the  
9 integrity and correct operation of buffers in the data  
10 plane, (vii) the integrity and correct operation of packet  
11 segmentation modules, (viii) the integrity and correct  
12 operation of packet reassembly modules, (ix) the integrity  
13 and correct operation of packet re-sequencing modules, (x)  
14 whether or not a node is restarting, (xi) whether or not  
15 the forwarding plane is congested, or (xii) the integrity  
16 and correct operation of fragmentation modules.

1 Claim 50 (original): The system of claim 46 wherein the  
2 forwarding liveness status information includes at least one  
3 of (i) bit error rate at a link interface, and (ii) clock  
4 synchronization at a link interface.

1 Claim 51 (new): The computer-implemented method of claim 1  
2 wherein the forwarding liveness status information of at  
3 least one of the at least two different interfaces included  
4 in the aggregated message includes a forwarding liveness  
5 state set to interface monitor not reporting.

1 Claim 52 (new): The computer-implemented method of claim 1  
2 wherein the forwarding liveness status information of at  
3 least one of the at least two different interfaces included  
4 in the aggregated message includes a forwarding liveness  
5 state set to forwarding engine restarting.

1 Claim 53 (new): The computer-implemented method of claim  
2 29 wherein the forwarding liveness status information of at  
3 least one of the at least two different interfaces included

4 in the first set of at least two different interfaces  
5 included within the aggregated message includes a  
6 forwarding liveness state set to interface monitor not  
7 reporting.

1 Claim 54 (new): The computer-implemented method of claim  
2 29 wherein the forwarding liveness status information of at  
3 least one of the at least two different interfaces included  
4 in the first set of at least two different interfaces  
5 included within the aggregated message includes a  
6 forwarding liveness state set to forwarding engine  
7 restarting.